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*Methodology for Analyzing
Global Reach -- Global Power*

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FOREWORD

In response to the extraordinary international developments of the past few years, the Secretary of the Air Force published a white paper, The Air Force and U.S. National Security: Global Reach--Global Power in June 1990. Secretary Rice's paper describes a planning framework to develop Air Force capabilities which, combined with the capabilities of the Army, Navy, and Marines, will underwrite U.S. national security strategy.

The changing environment offers significant challenges to the analysis community. To meet these challenges, the Air Force Center for Studies and Analyses is developing an analytical framework and a methodology for analyzing Air Force capabilities to provide Global Reach--Global Power.


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METHODOLOGY FOR ANALYZING GLOBAL REACH--GLOBAL POWER

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METHODOLOGY FOR ANALYZING GLOBAL REACH--GLOBAL POWER

"Extraordinary international developments over the last few years have created the potential for a significantly different security environment as we approach the beginning of the 21st century. These changes demand fresh thinking about the role of military forces..."

Donald B. Rice
Secretary of the Air Force
June 1990

INTRODUCTION

The recent extraordinary international developments have fundamentally changed the international security environment. As the threat appears to be receding in Europe, Department of Defense budget reductions are being sought to provide the "peace dividend" to offset U.S. economic challenges, such as the budget deficit, the trade imbalance, and the savings & loan bailouts. The decision-making pace has accelerated.

While the changes in the Soviet Union and Eastern Europe are encouraging, the threats to U.S. security have not vanished. The Soviet Union still remains a formidable military power whose nuclear weapons pose the most significant threat to our nation. In addition, the recent changes may have increased political, economic, and social instabilities throughout the world. Many historically unstable regions have nations with growing arsenals of increasingly sophisticated weapons. Besides preparing for conventional warfare, some of these nations have resorted to terrorism and to chemical weapons to achieve their political objectives. Libyan support for terrorism, the Iran-Iraq war and, most recently, Iraq's invasion of Kuwait illustrate these threats. To protect our national interests in an increasingly interdependent world, we must be able to globally project U.S. military power.

The Air Force has developed a planning framework, Global Reach--Global Power, to meet the military challenges of the evolving U.S national security requirements. The Air Force plans to tailor its force structure with flexible and responsive capabilities appropriate for this dynamic international security environment and complementary to the capabilities of the Army, Navy and Marines. These capabilities will provide the military power to underwrite our national security strategy.

OVERVIEW

This paper describes an analytical framework and a methodology for analyzing Air Force combat capability to provide Global Reach-Global Power. The Air Force Center for Studies and Analyses (AFCSA) developed this methodology to meet the analytical challenges posed by the new environment. The objective was to develop a qualitative and quantitative means to analyze Air Force force structure and force capability assessments against a multidimensional, global military threat. The methodology provides a process for integrating Air Staff analysis efforts to support our primary customers: the Secretary of the Air Force, the Chief of Staff, and the Major Commanders.

ANALYTICAL CHALLENGE

Air Force leaders and analysts are faced with two major military questions in the new security and budget environment. The first question involves fundamental reassessments of core Air Force missions. The second question involves assessing the impact of large budget reductions. While we have faced similar questions in the past, the new international security environment has caused the scope of the mission reassessments and the magnitude of the potential reductions to be the largest in the Cold War period. As we examine these questions, we must maintain our focus on providing the National Command Authorities with global power projection options that will deter an aggressor, stabilize a crisis, or resolve a crisis.

The reassessment of the Air Force's core missions began with Secretary Cheney's Major Aircraft Review (MAR). The C-17, the B-2, the Advanced Tactical Fighter, and the Advanced Attack Aircraft programs were scrutinized by teams of DoD experts. The MAR process examined the future threat, the modernization alternatives, and attempted to determine the minimum number of weapon systems. Although the initial MAR is complete, the Congressional reviews have begun and analysis must continue in these areas. In addition, other mission areas and other weapon systems will be reviewed by DoD senior leadership and Congress. The major questions will be: Do we need this mission area? What systems (if any) do we need to modernize? What is the minimum number of modernized systems we need to buy? The major basis for the mission area assessments will be the projected military operations and future threats to our national security.

The second type of challenge is the result of Congressional efforts to balance the federal budget. These requests require Air Force senior leadership to make difficult trade-offs between mission areas and determine militarily effective force structures.

Once these reductions have been apportioned to mission areas, U.S. force capabilities will depend on the projected military operations and future threats to our national security.

The critical analytical challenge for both types of questions is how to assess the interaction of alternative force structures against uncertain global military requirements. AFCSA has developed a methodology to address this challenge.

WHAT'S CHANGED -- NEW NEEDS AND NEW ANALYTICAL TOOLS

The needs of decision-makers have changed. There is no longer one dominant threat or one dominant scenario that can be used to determine our force structure. In an uncertain environment, the potential combinations of geo-political scenarios, varying threats, military operations, alternative force structures, and alternative weapon system capabilities are myriad. To support our senior Air Force leaders, we first need preliminary analyses to identify major options, and then more detailed analyses of the most significant options. In the following sections, this paper presents a methodology that addresses both these analytic needs.

The methodology requirements are the subject of the next section, but like all methodologies it must blend qualitative judgments and quantitative techniques. Fortunately, to meet the new challenges, analysts have developed improved qualitative and quantitative approaches.

The qualitative approach permits a systematic process to trace from national interests to political-military scenarios to military operations to required force qualities to weapon system capabilities. The process was successfully implemented by an interdisciplinary team of weapon system operators, acquisition officers, and operations research analysts.

The quantitative approaches draw on operations research techniques, computer hardware, and computer software to permit a more comprehensive assessment of the broad range of scenarios and weapons characteristics. Analytical options numbering in the millions can be assessed with a minimum number of simulation runs by the use of analyst judgment and the operations research technique of design of experiments. The setup time for each simulation can be reduced by improvements in databases and database interfaces. The runtimes for each simulation can be reduced by the advances in computer hardware. The quantity and quality of the results can be increased by the use of the operations research technique of response surface methodology. Finally, advanced computer graphics capabilities can improve the usefulness of the analysis to the decision-makers.

METHODOLOGY REQUIREMENTS

In order to examine the military capabilities required to provide Global Reach--Global Power, at a minimum the methodology must meet the following requirements:

1. Consider historical, current, and projected national interests.
2. Apply to all Air Force missions areas, conflict areas, and geographic locations.
3. Address all weapon system attributes (current, planned, and potential).
4. Be understood by analysts, planners, and senior Air Force leadership.
5. Provide value to senior Air Force leadership for the effort expended (opportunity cost).

METHODOLOGY OVERVIEW

The methodology defines a process flow that consists of three types of analysis: political-military, military operations, and operations research. The methodology attempts to bridge the gap between qualitative and quantitative analyses. The process flow for analyzing Global Reach-Global Power is shown in Figure 1.

The methodology is highly iterative -- issues discovered in one step may require re-examination of earlier steps or introduction of more detail. However, the possible feedback paths are deleted for clarity. The methodology has the following six steps:

1. Determine plausible political-military scenarios based on historical conflicts and U.S. national interests.
2. Identify potential military operations for each political-military scenario.
3. Identify critical force qualities for each mission.
4. Assess the ability of existing and planned weapon systems to provide the required force qualities.
5. Develop a study plan for the quantitative analyses. Identify potential force structures and measures of effectiveness (MOEs) for the mission area.

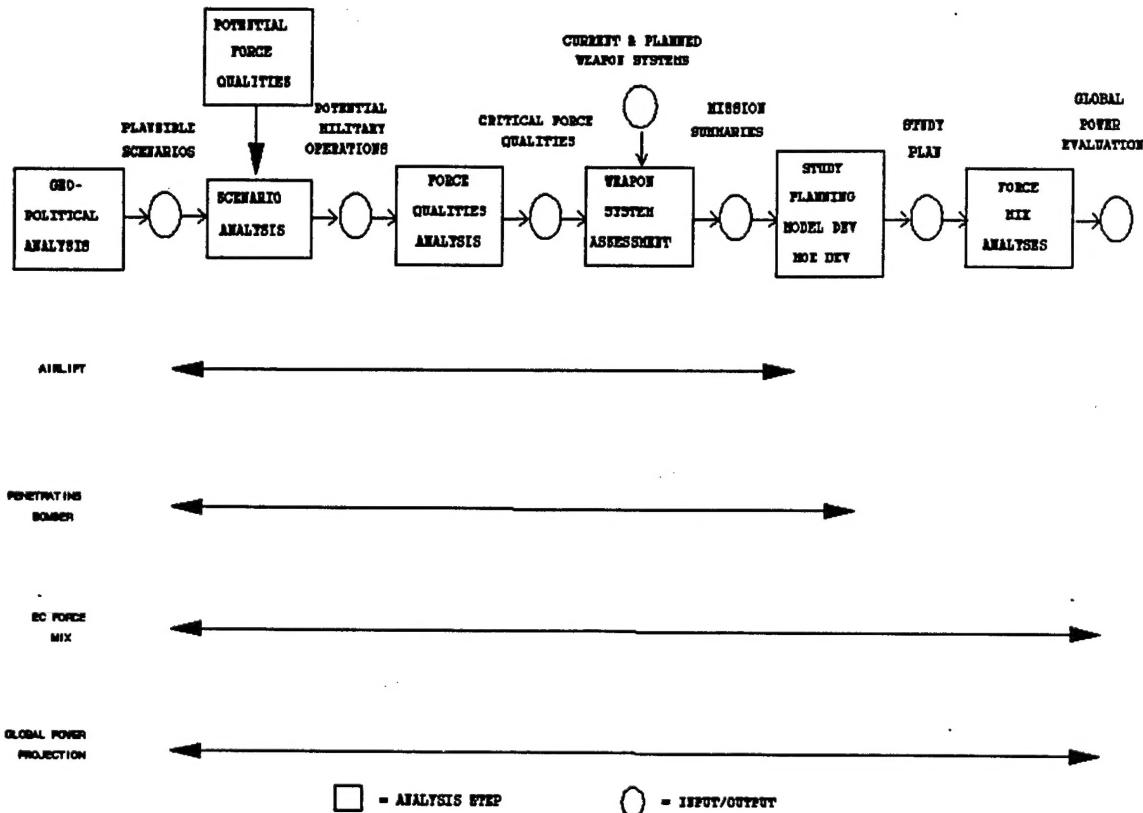


Figure 1: Methodology for Analyzing Global Reach--Global Power

6. Perform force mix analyses to quantify the effect of each significant variable on the MOEs.

The methodology can be applied to mission areas (e.g., Airlift) and mission support areas (e.g., Electronic Combat). The best way to illustrate the methodology is to provide examples.

ILLUSTRATIVE EXAMPLES OF THE METHODOLOGY

AFCSA has performed four major studies using this general methodology. The scope of each study relative to this methodology is shown in Figure 1. The Airlift Study and the Manned Penetrating Bomber Study were initiated as proof of concept studies for the methodology. Both studies were performed by interdisciplinary teams from several different AFCSA divisions. The Electronic Combat Force Mix Study is a single mission/multiple scenario study performed by the Electronic Combat Branch of the Tactical Systems Division (AFCSA/SAGR). The Global Power Projection Study described in this paper is a single scenario/multiple mission study performed by the Fighter Division (AFCSA/SAGF).

STEP 1: DETERMINE PLAUSIBLE POLITICAL-MILITARY SCENARIOS

The initial political-military analysis is crucial to the methodology. There is no longer one overriding military threat that can be used to assess force structure requirements. Therefore, we established plausible political-military scenarios based on historical, current, and projected national interests that bound the range of potential military conflicts. We were not predicting future conflicts; we were attempting to develop bounding scenarios that indicate where and how U.S. forces could be employed in support of our national interests.

We began with an examination of U.S. historical military conflicts. We examined regions of the world versus U.S. military objectives. Using this framework, we summarized many of the major historical U.S. military conflicts in Figure 2.

Our purpose was to examine historically how the U.S. has employed its military power to protect its national interests. Two important conclusions can be made from Figure 2. First, U.S. military conflicts have occurred worldwide for a variety of political-military objectives. Second, these historical conflicts were seldom predicted well enough in advance to provide adequate time to mobilize an adequate force structure at the start of the conflict.

For guidance on our current and projected national interests, we referred to the President's National Security Strategy (March, 1990). This document identifies our national interests, national objectives, military strategies, and military objectives. The major strategy elements relevant to this methodology are summarized in Figure 3.

The critical step in the methodology is the selection of the plausible analysis scenarios. We used the framework we developed in Figure 2 for our analysis of past military conflicts (regional areas versus military objectives). We see from Figure 4 that there are 54 possible combinations (9 regions times 6 objectives). Based on our historical, current, and projected interests, we assessed the level of future military conflict that might be plausible. We considered four levels of U.S. military involvement: military support; military support and limited force application; military support, limited force application, and deployed forces; and nuclear force employment. This assessment narrowed the range of plausible scenarios to 37 "more likely" scenarios. From these, we selected 8 scenarios that we believed bounded the potential future scenarios. The 8 scenarios covered each of the military objectives

MILITARY OBJECTIVES	REGIONAL AREAS								
	EUROPE	MIDDLE EAST	SOUTH AMERICA	CENTRAL AMERICA	ASIA	SE ASIA	SW ASIA	AFRICA	SPACE
NUCLEAR DETERRENCE	COLD WAR		CUBAN MISSILE CRISIS		COLD WAR				I & V
DEFEND AMERICA	SUPPORT WWII ALLIES DEFAT AXIS COLD WAR			SPANISH-AM. VAR	SPANISH-AM. VAR				WWII
DEFEND/ SUPPORT ALLIES	WWII WWII COLD WAR	1973 YOM KIPPUR	PALMELANDS	EL SALVADOR	KOREA. BOXER REBELLION	Vietnam	AFGHANISTAN		PALMELANDS
DEFEND LOCs	1912 WWI WWII					WWII	PERSEAN GULF		TRIPOLI GULF OF SIDRA
DEFEND ECONOMIC & POLITICAL INTERESTS	REVOLUTION GEOGRAPHY GREECE WEST INDIANS	LEBANON(1984) DESERT I LEBANON(1986)	CHILE	GUATEMALA PARMA(1969) DOMINIAN REPUBLIC(1962) NICARAGUA(1935) PERU-AM. VAR	GTW BOAT DIPLOMACY	PHILIPPINES (1898)	PERSEAN GULF	LIBYA CONGO ANGOLA	
SUPPORT DRUG WAR		TURKEY	COLOMBIA	PANAMA(1989)		BURMA			

1. U.S. MILITARY CONFLICTS HAVE BEEN WORLDWIDE FOR A VARIETY OF OBJECTIVES.
2. HISTORICAL CONFLICTS WERE DIFFICULT TO PREDICT.

Figure 2: U.S. Historical Military Conflicts

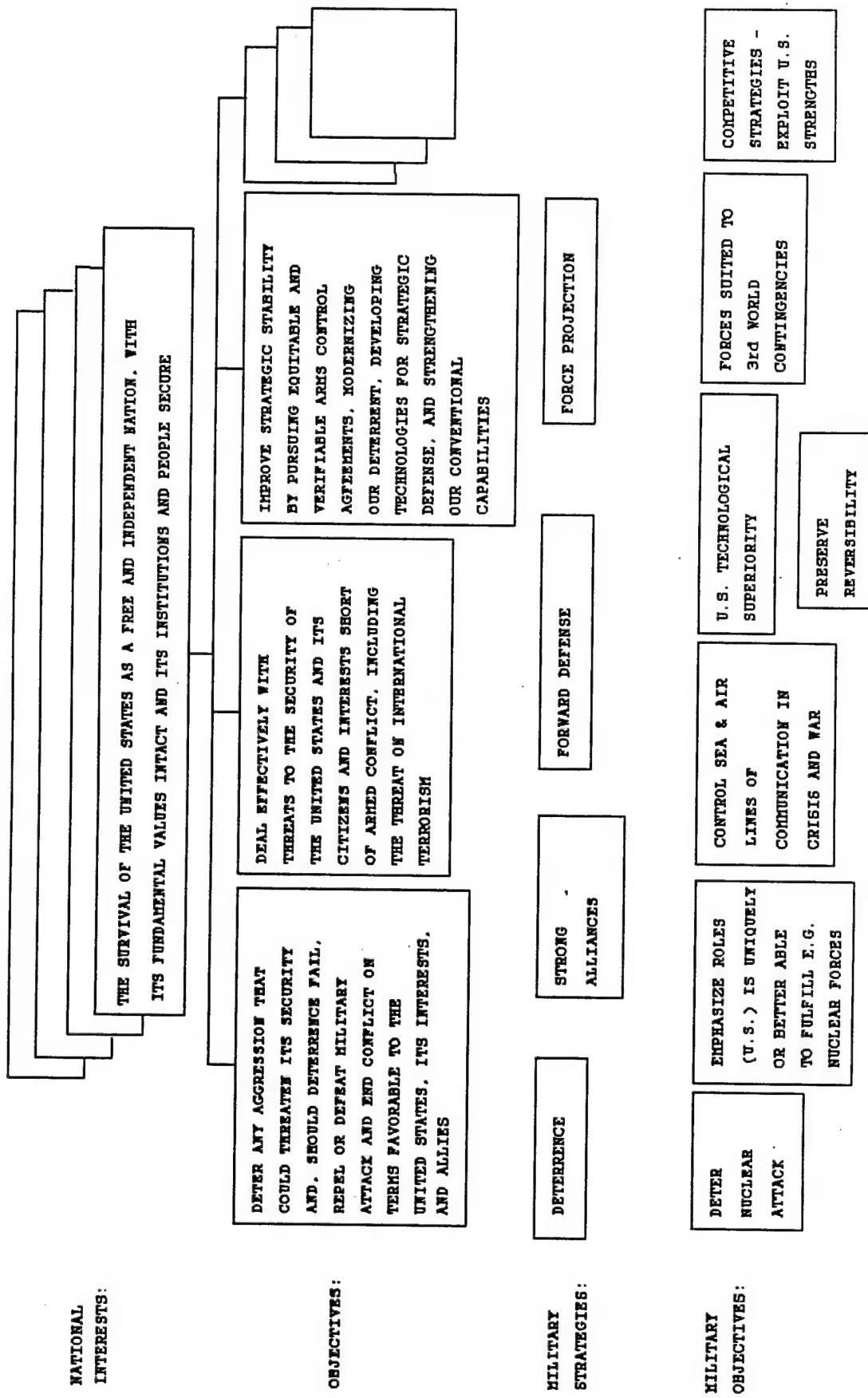


Figure 3: National Security Strategy of the United States

MILITARY OBJECTIVES		REGIONAL AREAS								
		EUROPE	MIDDLE EAST	SOUTH AMERICA	CENTRAL AMERICA	ASIA	SE ASIA	SW ASIA	AFRICA	SPACE
(NUCLEAR)	SOVIET UNION					3				3
DEFEND AMERICA	4 *									SOVIET UNION
(CONVENTIONAL)	3↑ *				3	3				3
DEFEND/ SUPPORT ALLIES		3↑ *	ISRAEL vs SYRIA			3 *				
DEFEND LOCs	3	1	3		KOREA vs KOREA	2				
DEFEND ECONOMIC & POLITICAL INTERESTS	2				2	2				
SUPPORT DRUG WAR							2			
				2	3 *	2	2			
					COLOMBIA					

1 = MILITARY SUPPORT

2 = 1 AND LIMITED FORCE APPLICATION

3 = 1, 2, AND DEPLOYED FORCES

4 = NUCLEAR SCENARIOS

3↑ POTENTIAL ESCALATION

TO THEATER NUCLEAR

54 TOTAL SCENARIOS

37 MORE LIKELY SCENARIOS

*8 BOUNDING ANALYTICAL SCENARIOS

Figure 4: Bounding Future Scenarios

and 6 of the 9 regions. These 8 plausible analytical scenarios provide potential worldwide military operations across the spectrum of conflict.

STEP 2: IDENTIFY POTENTIAL MILITARY OPERATIONS

To develop the eight scenarios we worked with the intelligence community, AF/XO, the Joint Staff, the Special Operations Command, and the MAC History Office. Two of the scenarios, Colombia and Israel-Syria, were developed to demonstrate the methodology. The major assumptions for each of the scenarios are shown in Figure 5.

COLOMBIA	ISRAEL-SYRIA
DRUG CARTELS INCREASE LEVEL OF VIOLENCE	TRADITIONAL REGIONAL POWER STRUGGLE REIGNITES
ESTABLISH MARRIAGE OF CONVENIENCE WITH ELN	
CARTEL PARA-MILITARY AND ELN FORCES LAUNCH ANTI-U.S. OFFENSIVE	SYRIA ATTACKS GOLAN HEIGHTS AREA
ACTIONS INCLUDE:	COMBINED ARMS WITH SUPPORTING AIR
KIDNAPPING U.S. CITIZENS	OTHER ARAB STATES (IRAQ) PROVIDE MEN AND EQUIPMENT
ASSASSINATING OFFICIAL U.S. PERSONNEL	USE OF TBMS AND CHEM WEAPONS LIKELY
ATTACKING EMBASSY W/ CAR BOMB	
U.S. INITIATES CITIZEN EVACUATION	THREE LEVELS OF POSSIBLE AMERICAN MIL SUPPORT
COLOMBIAN GOVERNMENT REQUESTS ADDITIONAL U.S. AID	RESUPPLY AND U.S. CITIZEN EVACUATION
IMMEDIATE MIL EQUIP RESUPPLY (HELOS & SMALL ARMS)	INTRODUCTION OF U.S. AIR FORCE AND NAVAL ASSETS
INCREASED MILITARY ADVISORS SUPPORT OF OPERATIONS	CONUS BASED HEAVY ARMOR UNITS INTRODUCED
MILITARY INTELLIGENCE SUPPORT	
INCREASED MILITARY MAINTENANCE SUPPORT	

Figure 5: Study Scenarios

Military operations were identified for each scenario. Three types of military operations were identified for the Colombia scenario: U.S. citizen evacuation, military equipment supply, and counterinsurgency operations. The military operations in the Israel-Syria scenario were U.S. citizen evacuation, military

equipment supply, Air Force air operations, and introduction of CONUS-based heavy armor units.

Once potential military operations were identified, we analyzed the scenarios to determine the basic activities performed for the airlift mission area. We used the following questions to guide our analysis: What operations must be performed? How would the operations be accomplished? When would the operations have to be completed? and Where would the operations be performed? While airlift is shown in our example, this approach is equally applicable to other mission and mission support areas.

The four questions were applied to each of the potential military operations in the scenario. Figure 6 summarizes the results of the analysis for the Colombia scenario. The answers to these questions provided the necessary information to identify the required airlift force qualities in the next step.

SCENARIO: COLOMBIA			
MISSION AREA: AIRLIFT			
	U. S. CITIZEN EVACUATION	MIL EQUIPMENT RESUPPLY	COUNTER INSURGENCY OPS
WHAT	AIRLIFT OF U. S. CITIZENS	FOOD, CLOTHING, SMALL ARMS, AMMUNITION, VEHICLES, HELICOPTERS, SPARE PARTS	SUPPORT TRANS REQTS FOR SPECIAL OPS FORCES AND INTERNAL SECURITY FORCES
HOW	MIL AIR TRANSPORT FROM COLOMBIA TO HOWARD OR CONUS LOCATIONS	AIR TRANSPORT FROM CONUS POOR INTERNAL TRANSPORT SYSTEM MANDATES SUPPLIES MOVEMENT BY AIR	USAF AIRLIFT ASSETS STATIONED IN-COUNTRY
WHEN	COMMENCE 24 TO 48 HRS AFTER PRESIDENTIAL AUTHORIZATION	WHILE INITIAL QUICK ACTION (POLITICALLY MOTIVATED) GRADUAL BUILD-UP LIKELY	GRADUAL BUILD-UP WITH LONG TERM OPERATIONS (SIMILAR TO HONDURAS)
WHERE	PRIMARY LOCATIONS: MAJOR CITIES	DEPOTS AND INTERNAL SECURITY FORCES OPERATING LOCATIONS	CLASSIFIED

Figure 6: Colombia Scenario

Similarly, Figure 7 summarizes the analysis for the Israel-Syria scenario.

SCENARIO: ISRAEL - SYRIA

MISSION AREA: AIRLIFT

	U. S. CITIZEN EVACUATION	MIL EQUIPMENT RESUPPLY	USAF AIR OPERATIONS
WHAT	AIRLIFT OF U. S. CITIZENS	AAMS, ACFT, TANKS, APCs AMMUNITION, SPARE PARTS	SUPPORT FOR USAF AND NAVY FORCES PROVIDING DIRECT FIRE SUPPORT
HOW	MAC AIRLIFT FROM ISRAEL TO CONUS LOCATIONS	AIR TRANSPORT FROM CONUS	DIRECT LANDING OR INTRA- THEATER TRANSPORT OF USAF UNIT MATERIALS
WHEN	COMMENCE 24 TO 48 HRS AFTER PRESIDENTIAL AUTHORIZATION	COMMENCE 24 TO 48 HRS AFTER PRESIDENTIAL AUTHORIZATION PIPELINE EST. 5-7 DAYS	COMMENCE 24 TO 48 HRS AFTER PRESIDENTIAL AUTHORIZATION
WHERE	PRIMARY LOCATIONS: MAJOR CITIES	FROM CONUS UNITS AND DEPOTS TO BEN GURION	APPROX. 12 OPS LOCATIONS WITHIN 200 NM OF GOLAN

Figure 7: Israel-Syria Scenario

STEP 3: IDENTIFY THE CRITICAL FORCE QUALITIES FOR EACH MISSION

The next step of the methodology required a listing of the important mission area force qualities. For the airlift mission area, the force qualities included range, critical leg length, airfield characteristics (construction, runway length, approach, and landing aids), survivability, cargo type/size, cargo delivery mode, and operating environment. The level of detail shown here is comparable to that required for most airlift capability analyses.

Since the quantitative steps in the methodology (Steps 5 and 6) require data that can be used in military capability models, the force qualities must be quantified to the degree necessary to build data bases that can be used for force mix analyses. Figure 8 summarizes the data bases developed for the two airlift scenarios. The level of detail shown here is comparable to that required for

OPERATIONS		EVACUATION		MIL RESUPPLY		COMBAT SUPPORT	
SCENARIOS		COLOMBIA	ISRAEL V SYRIA	COLOMBIA	ISRAEL V SYRIA	COLOMBIA	ISRAEL V SYRIA
RANGE	FORCE QUALITIES						
TOTAL TRAVEL DISTANCE		1700NM (EAST COAST) 3600NM (WEST COAST)	6600 NM (EAST COAST) 3600NM (WEST COAST)	1700NM (EAST COAST) 3600NM (WEST COAST)	6600 NM (EAST COAST) 3600NM (WEST COAST)	1700NM (EAST COAST) 3600NM (WEST COAST)	6600 NM (EAST COAST)
INTERHEATER LEG		400-2000NM (EAST) 3600 (WEST)	5200 - 6700 NM (EAST) (LOW ASYMMETRIC LOADS)	400-2000NM (EAST) 3600 (WEST)	3200 - 5700 NM (EAST) (LOW ASYMMETRIC LOADS)	400-2000NM (EAST) 3600 (WEST)	3200 - 5700 NM (EAST) (LOW ASYMMETRIC LOADS)
INFLATABLE LEG		NOT APPLICABLE	100 - 600NM	23 - 200 NM	50 - 250 NM	23 - 200 NM	23 - 200 NM
AIRFIELD							
ROUTE LENGTH							
RAMP, SPACE		CLASSIFIED	CLASSIFIED	CLASSIFIED	CLASSIFIED	CLASSIFIED	CLASSIFIED
TIME/PRECISE, SUPPORT							
CONSTRUCTION							
NAV AIDS LIMITATIONS							
SURVIVABILITY							
SURFACE -TO- AIR		CLASSIFIED	CLASSIFIED	CLASSIFIED	CLASSIFIED	CLASSIFIED	CLASSIFIED
AIR-TO-AIR							
SURFACE -TO- SURFACE							
CARGO TYPE/SIZE							
PAX		YES - SEVERAL 1000s	YES - SEVERAL 1000s	YES - COMBAT, SERV/SUP	YES - COMBAT, SERV/SUP	YES - COMBAT UNITS	YES - COMBAT UNITS
BULK		LIMITED	AMMO, SPARE PARTS	AMMO, ARMS, ETC	UNIT SUPPORT EQUIP	UNIT SUPPORT EQUIP	UNIT SUPPORT EQUIP
OVERSIZE		NO	VEHICLES	IFVs, CPTs, VEHICLES	VEHICLES	VEHICLES	VEHICLES
OUTSIZE		NO	NO	NO	NO	NO	NO
DELIVERY MODES							
GROUND		YES	YES	YES	YES	YES	YES
AIR DROP		NO	NO	NO	NO	NO	NO
COMBAT OFFLOAD		NO	NO	NO	NO	NO	NO
OPERATING TERRAIN							
MAIN CITIES		MAIN CITIES	MIL BASES / DESERT	MIL BASES / DESERT	JUNGLE / RIVER VALLEY	MIL BASES / DESERT	JUNGLE / RIVER VALLEY
SPACE SUPPORT			THREAT	THREAT	THREAT	THREAT	THREAT
INTELLIGENCE			MISSION PLANNING / UPDATE	MISSION PLANNING / UPDATE	MISSION PLANNING / UPDATE	MISSION PLANNING / UPDATE	MISSION PLANNING / UPDATE
WEATHER							
NAVIGATION			FUTURE	FUTURE	FUTURE	FUTURE	FUTURE
COMMUNICATIONS			CONNECTIVITY	CONNECTIVITY	CONNECTIVITY	CONNECTIVITY	CONNECTIVITY

Figure 8: Force Quality Summary

most airlift capability analyses.

STEP 4: ASSESS THE ABILITY OF EXISTING & PLANNED WEAPON SYSTEMS TO PROVIDE THE REQUIRED FORCE QUALITIES.

Once the critical force qualities have been identified and quantified, the next step is to assess the ability of existing and planned weapon systems to provide the required force qualities for each of the scenarios. Figure 9 summarizes our assessment. For each force quality, we identified the major limitations of the worst case scenario. Three examples are discussed to illustrate the types of qualitative results.

The C-130 is range limited and cannot deliver cargo from continental U.S. (CONUS) to Israel since it does not have the critical leg lengths or air refueling capability. Besides aircraft performance characteristics, there are other limiting factors. While the C-5 had an air refueling capability in the 1973 Arab-Israeli conflict CINCMAC would not allow C-5 air refueling due to inadequate crew training and relative inexperience with the aircraft. Finally, this approach highlights one of the across-the-board deficiencies: the lack of defensive countermeasures against surface-to-air, air-to-air, and surface-to-surface threats.

The remaining steps of the methodology will be illustrated by referring to the EC Force Mix study and the Global Power Projection Study. We will repeat Steps 5 and 6 for each of the two studies. The scope of these two studies was shown in Figure 1.)

STEP 5: DEVELOP STUDY PLAN FOR QUANTITATIVE ANALYSIS. IDENTIFY POTENTIAL FORCE STRUCTURES AND MEASURES OF EFFECTIVENESS FOR THE MISSION AREA. (EC FORCE MIX STUDY)

The next step involves the study planning for the quantitative analysis. The approach for the EC Force Mix Study is shown in Figure 10. The EC Force Mix study examined several threat scenarios and intentionally considered regions outside of Europe. The threat was analyzed in three dimensions: threat density (medium or high), threat mobility (fixed or mobile), and threat quality (old or new). Seven threat scenarios were developed in order of increasing lethality. (These scenarios were developed prior to the political-military scenarios described in Step 1 above.)

FORCE		AIRCRAFT				
QUALITIES	C-130	C-9	C-141	C-17	C-5	KC-10
RAVES						
TOTAL TRAVEL DISTANCE	LIN (TO AIR REFUEL)	LIN (TO AIR REFUEL)	LIN (REFUEL, CAVY TIE)			
INTERFARELLER LBS	LIN (TO AIR REFUEL)	LIN (TO AIR REFUEL)	LIN (REFUEL, CAVY TIE)			
INTERFARELLER LBS	FULL	FULL	FULL	FULL	FULL	FULL
AIRFIELD						
RUNWAY LENGTH	LIN (SOY COMBAT SUP)	LIN (SOY COMBAT SUP)	LIN (SOY COMBAT SUP)	LIN (SOY COMBAT SUP)	LIN (SOY COMBAT SUP)	LIN (SOY COMBAT SUP)
RAMP SPACE	LIN (SOY COMBAT SUP)	LIN (SOY COMBAT SUP)	LIN (SOY COMBAT SUP)	LIN (SOY COMBAT SUP)	LIN (SOY COMBAT SUP)	LIN (SOY COMBAT SUP)
HEM/PERSONNEL SUPPORT	LIN (3RD WORLD)	LIN (3RD WORLD)	LIN (3RD WORLD)	LIN (3RD WORLD)	LIN (3RD WORLD)	LIN (3RD WORLD)
CONSTRUCTION	LIN (SOY COMBAT SUP)	LIN (SOY COMBAT SUP)	LIN (SOY COMBAT SUP)	LIN (SOY COMBAT SUP)	LIN (SOY COMBAT SUP)	LIN (SOY COMBAT SUP)
NAV AIDS LIMITATIONS	LIN (3RD WORLD VFR)	LIN (3RD WORLD VFR)	LIN (3RD WORLD VFR)	LIN (3RD WORLD VFR)	LIN (3RD WORLD VFR)	LIN (3RD WORLD VFR)
MOVEMENTABILITY						
SURFACE-TO-AIR	CLASSIFIED	CLASSIFIED	CLASSIFIED	CLASSIFIED	CLASSIFIED	CLASSIFIED
AIR-TO-AIR						
SURFACE-TO-SURFACE						
CAMO TYPE/SIZE						
PAK	90 (C)/64 (T)	40 (C)/40 (T)	163 (C)/163 (T)	102 (C)/102 (T)	72 (C)/72 (T)	72 (C)/72 (T)
BULK	FULL (6 PALLETS)	NONE	FULL (14 PALLETS)	FULL (14 PALLETS)	FULL (36 PALLETS)	FULL (36 PALLETS)
OVERSIZE	LIN (SOME VEHICLES)	NONE	FULL	FULL	FULL	FULL
OPTIMED	NONE	NONE	NONE	FULL (<50 TONS)	FULL (<70 TONS)	FULL (<70 TONS)
DELIVERY MODES						
GROUND	LIN (3RD INFRA)	LIN (3RD INFRA)	LIN (3RD INFRA)	LIN (3RD INFRA)	LIN (3RD INFRA)	LIN (3RD INFRA)
AIR DROP	FULL	NONE	FULL	FULL	FULL	FULL
COMBAT OFFLOAD	FULL	NONE	FULL	FULL	FULL	FULL
OPERATING TERRAIN	FULL	FULL	FULL	FULL	FULL	FULL
SPACE SUPPORT						
NAVIGATION	NONE (GPS UPGRADE)	NONE (GPS UPGRADE)	NONE (GPS UPGRADE)	NONE (GPS UPGRADE)	NONE (GPS UPGRADE)	NONE (GPS UPGRADE)
COMMUNICATION	STEAD-ON VOICE	STEAD-ON VOICE	STEAD-ON VOICE	STEAD-ON VOICE	STEAD-ON VOICE	STEAD-ON VOICE

Figure 9: Weapon System Assessment

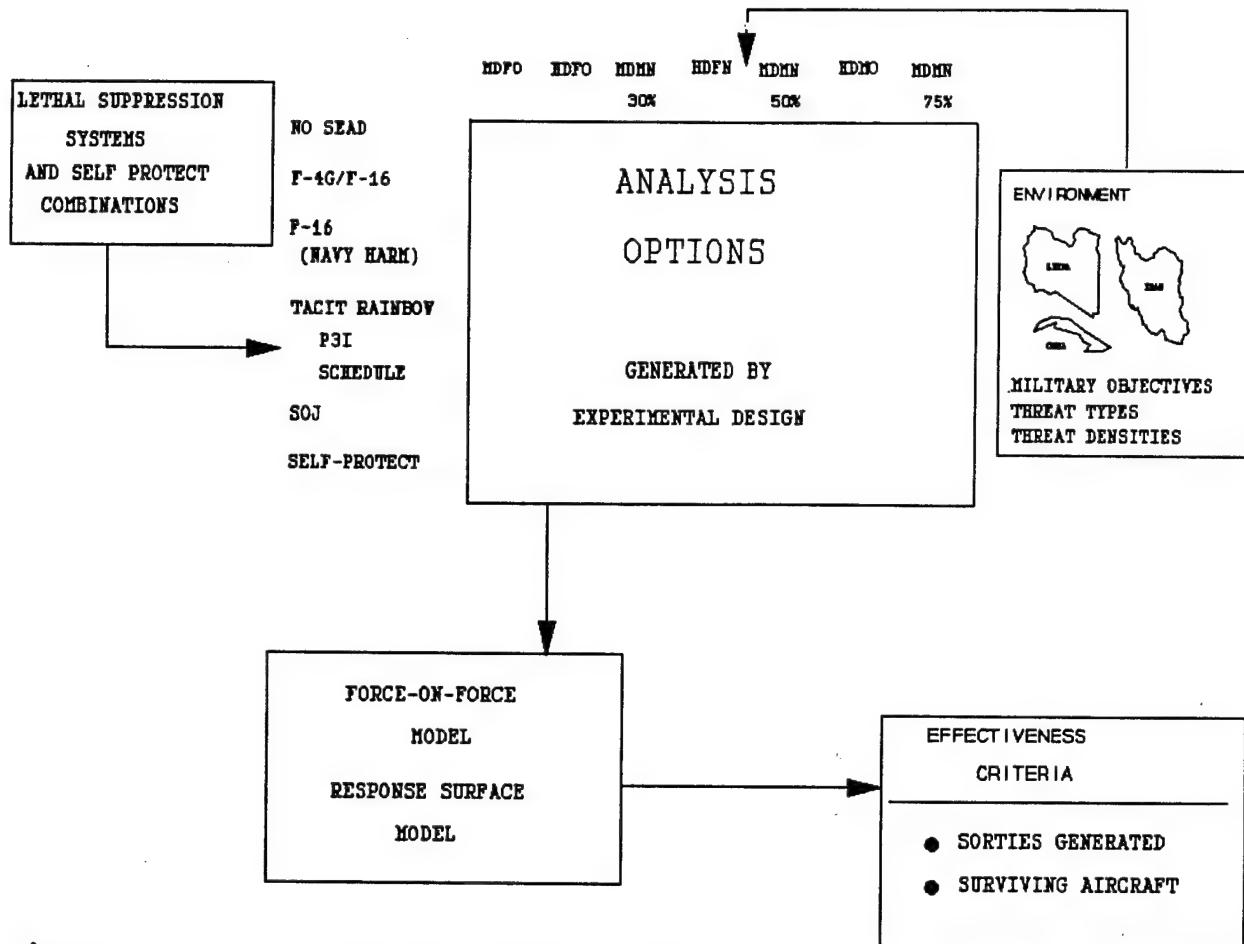


Figure 10: EC Force Mix Methodology

THREAT CATEGORY	ABBREVIATION	REPRESENTATIVE LOCATION
Medium Density, Fixed, Old	MDFO	Latin America 1 (LA 1)
High Density, Fixed, Old	HDO	Latin America 2 (LA 2)
Medium Density, Mobile, New 30%	MDMN30	Southwest Asia 1 (SWA 1)
High Density, Fixed, New	HDFN	Latin America 3 (LA 3)
Medium Density, Mobile, New 50%	MDMN50	Southwest Asia 2 (SWA 2)
High Density, Mobile, Old	HDMO	Middle East
Medium Density, Mobile, New 75%	MDMN75	Europe Flank

The EC force structure alternatives included self-protection and lethal suppression systems. The analysis options included self-protection electronic countermeasure (ECM) systems, stand-off jammers, non-lethal suppression of enemy air defenses (SEAD), Tacit Rainbow, F-16 (Navy HARM), and F-4G/F-16. Initially, the potential combinations of force structures (aircraft and equipment) and threat scenarios amounted to approximately 13 million. The number of analysis options was reduced to approximately 250 by using analyst judgment and the operations research technique of experimental design. Two major MOEs were selected for the study: the number of surviving aircraft and the number of sorties generated.

STEP 6: QUANTIFY THE EFFECTS OF EACH SIGNIFICANT VARIABLE ON THE MOEs (EC FORCE MIX STUDY)

The analysis runs used a force-on-force model (TAC EC) and response surfaces (multidimensional regression equations) for each MOE. The response surface coefficients provide the impact on the MOE of each of the major factors analyzed in the study.

For each MOE, the response surface shows the effects of each of the significant factors analyzed in the study. Figure 11 shows the results for the Percent of Surviving Aircraft. The relative contributions of the baseline, the non-lethal systems, and each lethal system contribution are shown for each threat scenario.

These results provide an assessment of the mission support area. The results depict the relative contributions of the EC systems for a worldwide set of threat scenarios.

These results can also be used to evaluate the impact of budget cuts in the mission area. For example the impact of retiring the Lethal System B is depicted in Figure 11. For example, the percent of surviving aircraft in MDMN75 drops from 35 to 20 without the Lethal System B.

One of the benefits of this methodology is the ability to rapidly assess the impact of a new scenario. A new scenario can be evaluated and compared to the analyzed scenarios. For example, a threat scenario that falls between MDMN30 and HDFN would be irrelevant to the Lethal System B budget decision. However, a threat scenario that falls between HDMO and MDMN75 might be very important to the budget decision.

Next, we will return to Step 5 and describe the Global Power Projection Study. The Global Power Projection Study presented in this paper is a single scenario/multiple mission analysis.

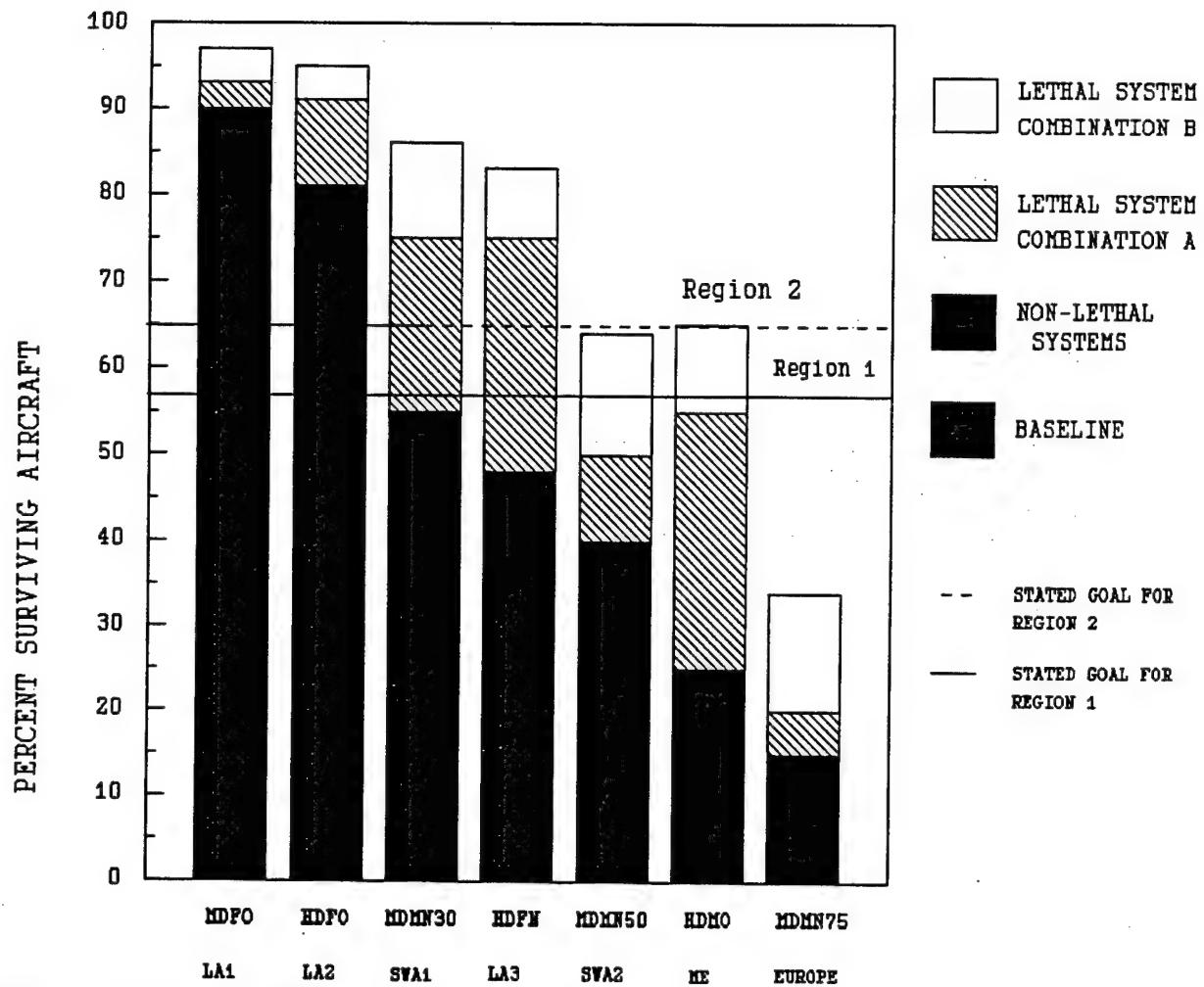


Figure 11: EC Force Mix Results

STEP 5: DEVELOP STUDY PLAN FOR QUANTITATIVE ANALYSIS. IDENTIFY POTENTIAL FORCE STRUCTURES AND MEASURES OF EFFECTIVENESS FOR THE MISSION AREA. (GLOBAL POWER PROJECTION STUDY)

Again, this step involves the study planning for the quantitative analysis. The Global Power Projection Study methodology is displayed in Figure 12. The analysis options were determined by the number of scenarios and the alternative force package combinations. The study will examine several threat scenarios. The scenario presented in this paper is a SWA scenario. The study will eventually examine other scenarios including: Central Europe, Korea, Panama, and a Libya Raid-type scenario. The methodology uses force packages that includes forces from the Air Force, Army, Navy, and Marines. The types and quantities of forces are one of the major input variables of the study.

The force on force model used in the study is the Stella Combat Assessment Model. Stella is a simulation language that runs

on a PC. Four measures of effectiveness were used in the study: enemy target destruction, U.S. aircraft attrition, enemy cumulative advance, and enemy force attrition.

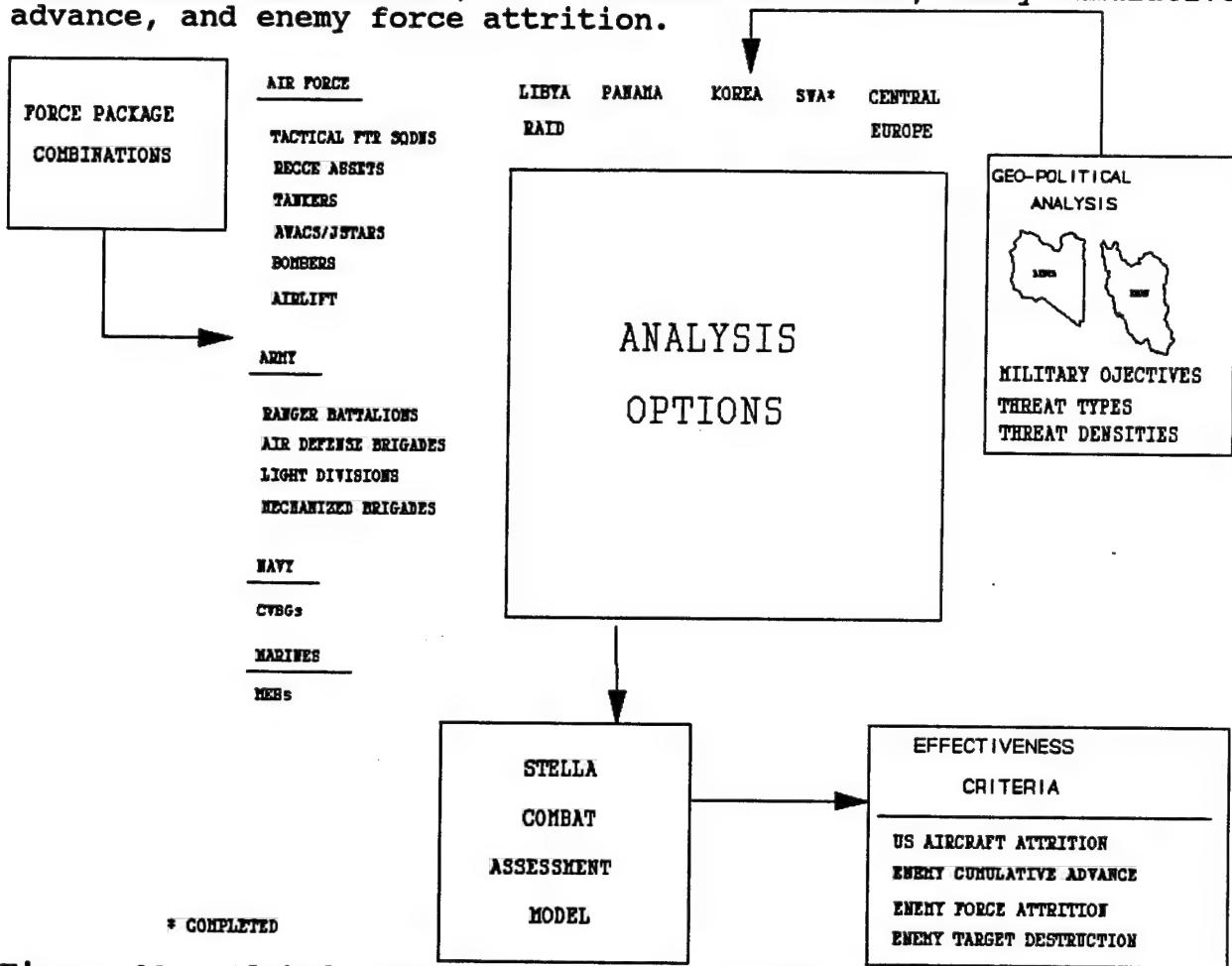


Figure 12: Global Power Projection Methodology

STEP 6: QUANTIFY THE EFFECTS OF EACH SIGNIFICANT VARIABLE ON THE MOEs (GLOBAL POWER PROJECTION STUDY)

Figure 13 displays representative results for one of the MOEs in this study. Four alternative force packages were used: the base case, the base case with a 30% increase in lift capacity, the base case with strategic bombers used early in the conflict, and the base case with both the increase in lift and the strategic bombers. The MOE used was the days to destroy a target set made up of four categories of targets. Each target category was defined by the number of targets and the percentage required to be destroyed.

The results of this study can provide a global power projection evaluation and can be used to assess the impact of budget changes.

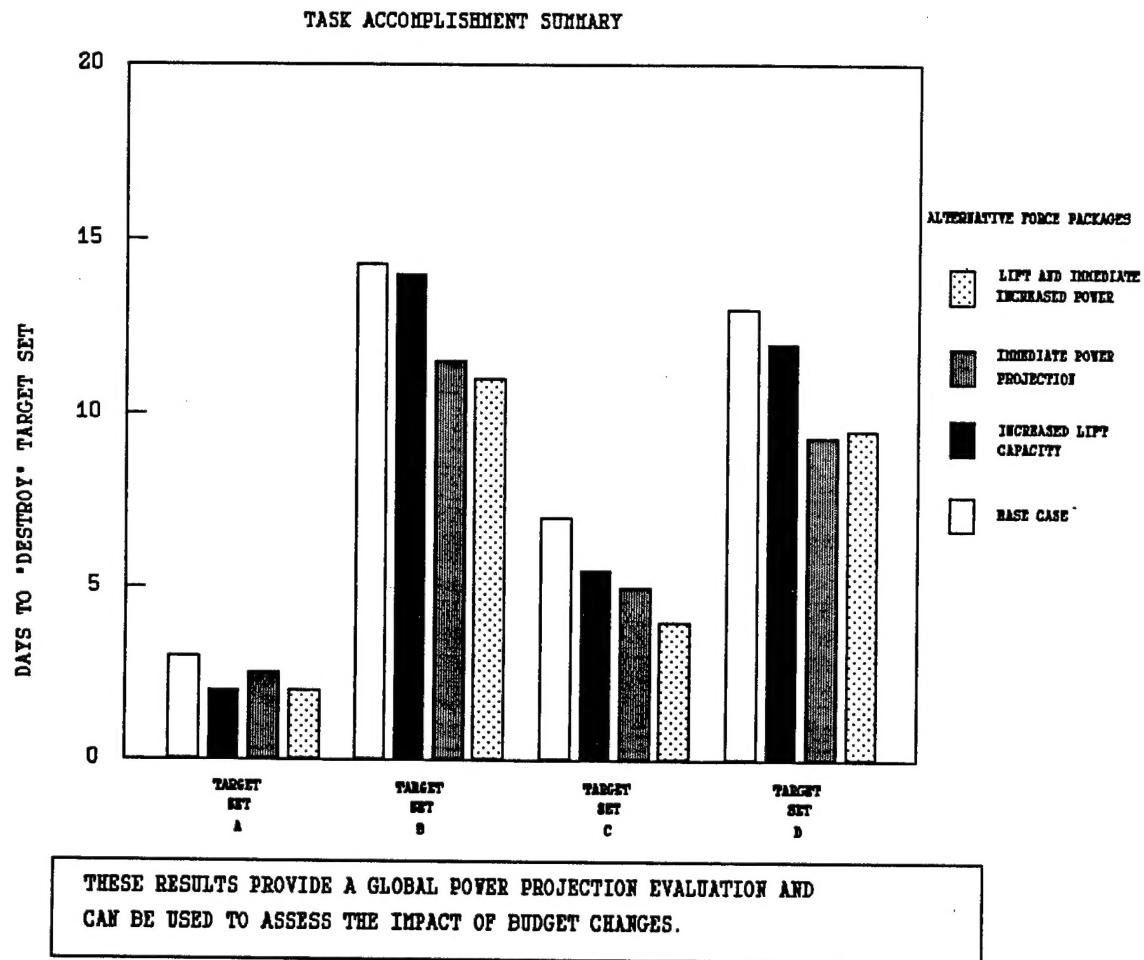


Figure 13: Global Power Projection Results

HOW CAN THE METHODOLOGY BE USED?

We believe this methodology has many important uses for many different organizations. The methodology can be used for both qualitative (Steps 1 through 4) and quantitative analyses (Steps 1 through 6). The methodology can be used for one or more of the following purposes:

1. As a systematic approach to generate scenarios.
2. As a framework for mission area analysis.
3. As a framework for requirements development.

4. For quantitative study planning.
5. For MOE development.
6. For data base development.
7. For force structure analyses.

The methodology has significant applications in the acquisition community. For example, the qualitative and quantitative mission area assessments of this methodology would be very useful for early milestone decisions.

Many organizations could become involved with this methodology: Airstaff, MAJCOMs, CINCs, and Joint Staff. While we only considered examples with Air Force missions, the same methodology could be used to examine joint missions. For example, the methodology could be used to examine scenarios involving airlift and sealift. In order to achieve maximum benefit, the methodology would have to be institutionalized and integrated within these organizations.

METHODOLOGY IMPLEMENTATION CHALLENGES

The methodology has significant implementation challenges because of the large investment required to perform the initial analyses and the large number of organizations involved.

The EC Force Mix took twice as long as a normal study that used fewer scenarios and a smaller range of force structure alternatives. However, the amount of insight gained from the study is significantly greater. In addition, we estimate follow-on studies can be accomplished in one-fourth the time of a normal study.

Furthermore, investments in hardware and software may be required to fully take advantage of this methodology for some mission areas or mission support areas.

WHY THE AF SHOULD ADOPT THIS METHODOLOGY

The methodology is summarized in Figure 14. The Air Force should adopt this methodology for three major reasons. First, it is no longer credible to analyze a single scenario -- we must consider multiple scenarios. Second, because of the evolving national security environment, our core mission areas will continue to come under close scrutiny. Third, the Air Force senior leadership will be required to make very difficult budget and mission area tradeoff decisions.

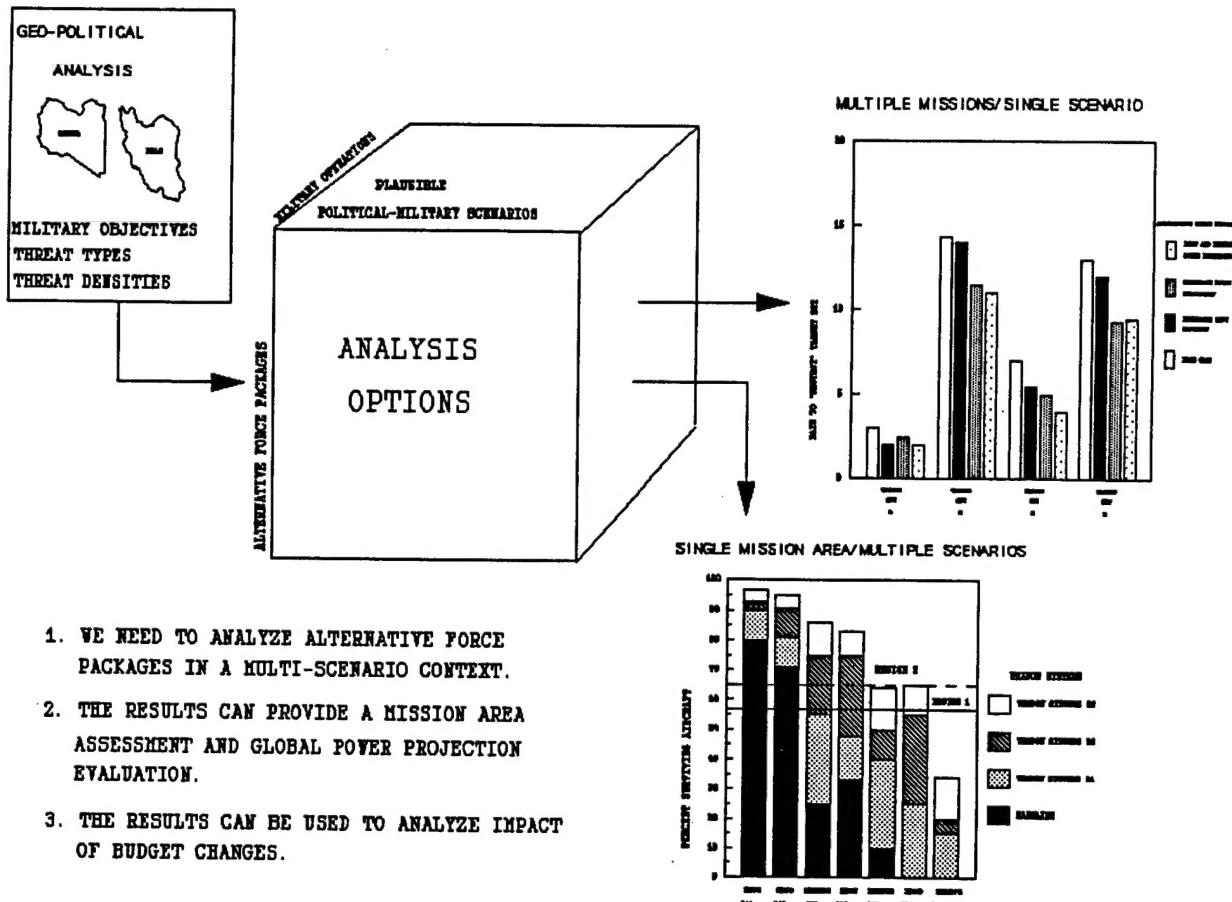


Figure 14: Methodology for Analyzing Global Reach--Global Power

There is no longer a consensus on the one-threat scenario that drives weapon system requirements. We need a flexible methodology to analyze alternative forces in a multi-scenario context. This methodology develops multiple plausible scenarios that bound the geographic regions where the U.S. may be required to project global power.

Our core missions will continue to be closely examined by DoD and congressional leaders. The Major Aircraft Review demonstrated the need to address fundamental qualitative as well as quantitative questions.

A systematic reassessment of our core missions will prepare Air Force leaders for the future decisions. In this new environment, the Air Force must be able to assess the impact of budget cuts in our core missions.

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Lt Col Richard L. Eilers is responsible for many of the central ideas of this methodology. Lt Col Eilers and Lt Col Philip A. Richard performed the Airlift Study. Lt Col Gregory S. Parnell, Lt Col John A. Rolando, Lt Col Larry D. Autry, Major Robert L. Bivins, Major Patricia M. Fornes, and Major Patrick J. Thomas performed the Manned Penetrating Bomber Study. The EC Force Mix Study was performed by Major John L. Burkhart, Capt Maureen Harrington, and Capt Steven Satchwell of the Electronic Combat Branch of the Tactical Systems Division. The Global Power Projection Study was performed by the Fighter Division by Major Gregg L. Burgess.

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